HOW TO WRITE A GOOD PROPOSAL: TIPS, INSIGHTS, AND PERSPECTIVE

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Thanks to Jim Kurose for sharing earlier slides
MARY HALL

• Professor in School of Computing at Utah (since 2008)
  • Previously, Research Assistant/Associate Professor at USC and jointly Project Leader at USC/ISI (1996-2008)
• Research interests
  – Parallel computing, HPC, programming systems, compiler optimization
• Funding sources
  – NSF, DOE, DARPA, Other DOD, industry
• Funding history
  – First funding as PI from DARPA in 1996, 40 projects over 20 years
  – Many multi-disciplinary and multi-institutional efforts
• Related activities
  – Peer reviewer for NSF, DOE and “NSF-equivalent” for other countries
  – Co-author of several reports helping to set research direction in my area for NSF, DOE and DARPA
• CRA Board Member since 2015
SUSANNE HAMBRUSCH

- Professor of Computer Science at Purdue
- Department Head 2002-07
  - Write proposals outside ones area; fundraising
  - Hire and mentor junior faculty, faculty promotions
- Division Director (NSF/CISE/CCF) 2010-13
  - Develop new programs (e.g., XPS, Algorithms in the Field)
  - Sign off on final proposal decisions
- Funding sources
  - NSF, ONR, Army, DARPA, Microsoft, State Farm, and others
- Research interests
  - Analysis of algorithms, CS education, parallel computing
- Current CRA affiliations
  - CRA Vice-Chair, CRA-E co-chair; CRA-W board member
1: Pick good problem(s)

- why is the problem important?
  - how does current context make this problem timely?
  - what happens if you do not solve it?

- new fundamentals/principles involved?
  - universal truths (best) versus point solutions (not as good)

- why is this the right problem for you to solve?
  - balance between experience and new directions

- a problem area with “legs”?
  - is this fundamental work leading to lots of future work?

A fool can ask more questions in a minute than a wise man/woman (or a Yoda) can answer in a lifetime
2: Every proposal tells a story

- story is *not* what you will do, but rather
  - what you will show, new ideas, new insights
  - story pitch may differ between programs and agency
- why is the story of interest to others?
  - universal truths, hot topic, surprises or unexpected results
- know your story!
- practice your “elevator speech”
  - reflect in summary and intro
3: *What* will you do? *How* will you do it?

- basic questions all reviewers will ask
- so *ask and answer these questions* for the reviewers in your proposal

*what* – questions to be addressed

*how* – methodology to address questions
4: Specific research questions

- clear problem statements
  - pose questions, show initial results, demonstrate methodology
  - questions alone aren’t enough
  - how will you address them?

- some near-term problems that you have an idea how to attack

- list longer term problems that you may only have vague idea of how to solve
  - showing longer term issues is important for multi-year efforts (e.g., CAREER)
5: Initial work

- must be done before proposal
- initial results demonstrate feasibility
  - illustrative, explanatory to reviewer
  - provide intuition about what you will do
- but if the problems are basically solved already, then it’s not proposed research
- illustrate approach(es) to solving problems
  - show you possess right skill set
6: Past work

- be specific about past related work, how proposed research differs
  - reviewers are knowledgeable, aware of past work [sometimes they did the past work you are citing!]
  - establish current state of the art
  - what is the **value added** of proposed work, not just difference

"What Descartes did was a good step. You have added much . . . . If I have seen a little further it is by standing on the shoulders of Giants."

Sir Issac Newton, 1676
7: Introduction

- If reviewer is not excited by intro, proposal is lost

- Recipe to follow:
  - para. 1: motivation: broadly, problem area, why important?
  - para. 2: narrow down: what is problem considered? what is the current state of the art for solving problem? why is it insufficient?
  - para. 3: “In this proposal, we ....”: most crucial paragraph, tell your elevator pitch; make it easy to read
  - para. 4: how different/better/relates to other work; brief
  - para. 5: summarize your contributions at higher level, long-term 10K foot view of contribution: change the world! Brief summary of high level research plan
  - para. 6: ... remainder of proposal structured as follows ...
  - figure: high-level figure that establishes a mental framework for proposed project can also go in this section
9: Submit to a program funding the research you propose

- understand goals of program/solicitation
  - ask people who know, don’t assume or guess
  - essential for cross/special programs
  - what/who has been funded recently
  - communicate with program directors

- if your research fits into more than one program, communicate with relevant program directors before the submission
  - proposals don’t always get moved or shared
10: Know the review process

NSF’s merit review process

- proposals sorted and assigned to panels based on the summary
- A reviewer may read 10-15 proposals
  - lots of work, tiring
- reviewers will either be panelists present at NSF or participating in a virtual panels

Other agencies

- peer review vs. internal review
- may be less transparent
11: Put yourself in place of reviewer

- less is more
  - “I would have sent you less if I had had time”
  - take the time to write less; don’t overwhelm with details
  - avoid redundancy

- reviewers shouldn’t have to do extra work
  - they won’t “dig” to get story and understand context
  - need textual signposts to know where ‘story” is going, context to know where they are
    - good: “e.g., Having seen that ... let us next develop a model for .... Let Z be ....”
    - bad: “Let Z be”

- write for the reader, not for yourself
12: Again, put yourself in place of reviewer

- page upon page of dense text: *no fun* to read
  - avoid cramped feeling of tiny fonts, small margins
  - create openness with white space: figures, lists

- provide enough context & information for reviewers to understand what you write
  - no one has as much background/content as you
  - no one can read your mind
  - define all terms/notation
13: Master the basics of organized writing

- **paragraph** = ordered set of topically-related sentences
  - sentences should have logical narrative flow

- **lead sentence**
  - sets context for paragraph
  - usually ties to previous paragraph

- **don’t**
  - mix tenses in descriptive text
  - use one sentence paragraphs or sentences with multiple clauses

"No tale is so good that it can't be spoiled in the telling"
Proverb
14: Write top down

- computer scientists (and most human beings) think this way!
- state broad themes/ideas/questions first, then go into detail
  - context, context, context
- even when going into detail ... write top down!
15: Good proposal writing takes time

- give yourself time to reflect, write, review, refine
- give others a chance to read/review and provide feedback
  - get a reader’s point of view
  - find a good writer/editor to critique your writing
  - you may get contradictory advice
- starting a proposal two weeks before deadline?
  - won’t generate great ideas
  - difficult to tell a cohesive story without iteration
16: Learn from Declinations

- Declinations happen to everyone; get used to them.
- Learn from a declination:
  - Why was paper/proposal rejected?
  - What did/didn’t reviewers see/like?

- ..... but don’t revise assuming the same reviewers will review your proposal (paper). They won’t!
ABOUT NSF PROPOSALS
WHAT MAKES A PROPOSAL TO NSF SUCCESSFUL

- Choose a good problem related to your expertise but not continuing the PhD research
- Be enthusiastic and bold about your research
- Get mentoring and help in preparing a proposal
- Understand and follow our tips
- Read the solicitation and watch its webinar
- Know the proper home for your proposal and talk to a cognizant program manager before submitting
- Understand intellectual merit and broader impact
INTELLECTUAL MERIT AND BROADER IMPACT CRITERIA

All NSF proposals are reviewed according to:

- **Intellectual Merit** encompasses the potential to advance knowledge.

- **Broader Impacts** encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.
  - Weak: “My research results will be my broader impact,” “I will train my graduate students to be like me,” “I am teaching seminar courses”
  - Impact on diversity, mentoring, K-12 outreach is stronger

- read the proposal guide: [PAPPG](#)
HOW IMPORTANT IS THE BUDGET?

- Read guidelines carefully. Talk to someone in your business office
- Special programs can have different budget requirements
- Limits are strictly enforced
  - $505K on a $500K limit: expect return without review
- Overhead and RA costs differ by institution
  - You don’t have to meet the upper limit
- NSF reviewers are asked to not evaluate the budget
WAYS TO JUMP-START PROPOSAL WRITING

- Be a proposal reviewer
  - have someone send your name to the right PD
  - you learn by seeing the process
- Team up with a more experienced researcher on a first proposal
  - but don’t lead a big proposal effort
- Read proposals others in your area have written
  - *ask:* many people will give you a copy
- Attend proposal-writing workshop
  - this one or ones at your institution
  - NSF’s [Career Proposal Workshop](http://example.com), March 16, 2016
WHAT TO DO AFTER A DECLINE?

- Recognize that it happens to everyone
- Contact the Program Director and set up a time to call (prepare questions)
- Don’t take individual reviews personally
- Don't complain that the reviewers were incompetent
- Talk to your mentor and others you trust
- Make new proposal plans
- Continue to work on the problem
  - A declined proposal does not mean your research is not worth pursuing
QUESTIONS?